Supplement of Biogeosciences, 17, 3367–3383, 2020
https://doi.org/10.5194/bg-17-3367-2020-supplement

Biogeosciences Open Access EGU

Supplement of

From fibrous plant residues to mineral-associated organic carbon – the fate of organic matter in Arctic permafrost soils

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Table S1: Basic properties of bulk soil samples and result of the fractionation**:** pH (measured in H_2O), EC (µS cm^{-1}), bulk density (g cm^{-3}), C (mg g^{-1}), N (mg g^{-1}), C/N ratio and the distribution of SOM fractions (mg g^{-1}) for the bulk soil samples of all analyzed depth layers. The particulate organic matter fractions are free (fPOM), occluded (oPOM) and small occluded (oPOMs) particulate organic matter.

	depth	**pH**	**EC**	**bulk density**	**C**	**N**	**C/N ratio**	**distribution of SOM fractions**					
								particulate OM fractions					*mineral-associated OM fractions*
								fPOM	oPOM	oPOMs	clay-sized	silt-sized	sand-sized
	cm	(H_2O)	µS cm^{-1}	g cm^{-3}	mg g^{-1}	mg g^{-1}		---------- mg g^{-1} ----------					
core 1	11-22	5.5	69	0.3	55.2	1.6	36	107.6	5.9	4.4	98.4	192.3	591.5
	22-30	6.5	153	0.3	61.9	2.2	29	103.6	16.5	9.0	141.6	294.2	435.1
	30-40	6.2	87	0.4	32.9	1.4	24	36.4	14.0	9.5	113.5	257.6	568.9
	40-50	6.0	98	0.3	48.9	1.5	33	89.7	13.4	7.4	138.3	286.5	464.6
	50-62	5.4	69	0.6	47.5	1.9	25	70.6	12.1	12.1	134.5	243.9	527.8
	62-75	5.3	87	0.4	60.3	2.4	25	91.2	19.2	17.7	181.7	311.8	378.4
core 2	30-40	5.1	117	0.4	95.8	2.8	34	223.7	27.0	5.4	171.7	314.8	257.4
	40-50	5.1	174	0.3	109.8	3.6	31	260.6	20.8	13.1	244.5	336.8	124.2
	50-60	5.1	240	0.2	144.0	3.8	38	295.0	22.9	218.4	122.5	247.2	94.1
	60-70	4.9	203	0.4	61.7	2.4	26	99.2	57.8	267.2	101.3	395.6	79.0
core 3	11-20	6.6	85	0.5	45.8	1.3	37	62.8	52.5	82.3	37.2	182.4	582.8
	20-30	6.1	75	0.9	31.6	1.3	25	30.2	30.0	116.0	43.7	255.1	525.0
	40-50	5.8	134	0.4	47.9	2.1	23	169.6	20.5	176.4	97.7	305.2	230.6
	59-68	6.0	76	0.9	52.2	2.0	26	115.6	11.1	125.4	60.1	316.6	371.2
	68-80	5.8	124	0.4	135.7	4.3	32	206.8	71.7	167.1	124.8	301.6	128.1
core 4	0-10	5.5	76	0.4	56.2	3.3	17	155.5	6.6	18.2	119.6	197.0	503.0
	10-20	5.8	66	0.6	33.2	1.5	22	75.7	3.0	3.9	121.8	241.9	553.7
	20-30	5.6	82	0.6	37.6	2.0	19	50.2	8.9	12.7	148.6	315.8	463.9
	30-40	5.6	125	0.4	77.8	3.1	25	202.0	15.2	15.8	176.8	265.5	324.7
	40-50	6.0	73	0.9	33.5	2.2	15	16.2	8.7	22.8	163.5	366.1	422.8
	50-60	5.7	121	0.7	84.5	6.3	13	10.6	34.3	111.7	214.5	439.6	189.3
	60-70	5.5	161	0.3	85.5	6.3	14	11.3	37.2	125.5	216.7	467.0	142.2
	70-79	5.6	147	0.3	91.7	6.8	14	13.7	30.2	133.0	231.6	479.3	112.2

Table S2: Properties of SOM fractions: C per fraction (mg C (g soil)$^{-1}$), N per fraction (mg N (g soil)$^{-1}$), C/N ratio, $\delta^{13}C$ (‰ V-PDB) and $\delta^{15}N$ (‰ air N_2) for free particulate (fPOM), occluded particulate (oPOM), small occluded particulate (oPOMs) and clay-sized mineral-associated organic matter (MAOM).

		fPOM					**oPOM**					**oPOMs**					**clay-sized MAOM**				
	depth	C per fraction	N per fraction	C/N ratio	$\delta^{13}C$	$\delta^{15}N$	C per fraction	N per fraction	C/N ratio	$\delta^{13}C$	$\delta^{15}N$	C per fraction	N per fraction	C/N ratio	$\delta^{13}C$	$\delta^{15}N$	C per fraction	N per fraction	C/N ratio	$\delta^{13}C$	$\delta^{15}N$
	cm	mg C (g soil)$^{-1}$	mg N (g soil)$^{-1}$		‰ V-PDB	‰ air N_2	mg C (g soil)$^{-1}$	mg N (g soil)$^{-1}$		‰ V-PDB	‰ air N_2	mg C (g soil)$^{-1}$	mg N (g soil)$^{-1}$		‰ V-PDB	‰ air N_2	mg C (g soil)$^{-1}$	mg N (g soil)$^{-1}$		‰ V-PDB	‰ air N_2
core 1	11-22	765.9	361.4	76	-26.9	1.4	41.2	28.6	52	-26.2	1.3	19.4	45.6	15	-27.3	1.0	147.2	453.4	12	-27.0	1.8
	22-30	641.6	366.3	51	-28.2	0.7	108.3	56.4	55	-27.8	1.0	36.0	61.2	17	-28.0	0.9	188.8	428.7	13	-28.1	1.8
	30-40	437.1	164.1	64	-26.5	0.9	174.1	61.9	68	-26.4	0.9	69.7	106.8	16	-27.5	0.8	270.3	534.2	12	-27.2	1.7
	40-50	674.8	311.1	71	-26.8	0.9	106.7	51.5	67	-25.8	1.2	27.6	54.1	17	-27.1	1.0	152.2	445.9	11	-27.2	2.1
	50-62	588.3	305.4	49	-28.3	0.8	105.6	42.2	64	-28.0	1.4	50.5	90.6	14	-28.4	1.1	222.2	470.2	12	-28.5	-0.4
	62-75	533.1	300.3	44	-26.0	1.0	134.6	56.1	60	-25.3	1.0	76.7	114.4	17	-26.9	1.1	218.4	438.0	13	-26.9	1.1
core 2	30-40	780.3	508.2	53	-26.8	0.8			*outlier*			13.7	31.5	15	-27.3	0.9	118.0	358.2	11	-27.8	1.6
	40-50	722.0	438.5	50	-27.1	0.9	71.7	35.0	63	-26.5	1.1	30.7	55.5	17	-26.9	0.7	158.2	424.3	11	-27.5	1.6
	50-60	674.6	384.9	66	-26.3	1.0	58.5	40.1	55	-26.4	1.1	194.7	367.6	20	-26.5	1.8	64.4	176.0	14	-26.0	3.2
	60-70	538.8	226.8	61	-25.7	0.7			*outlier*			265.7	514.4	13	-26.6	2.8	92.7	161.5	15	-26.9	3.4
core 3	11-20	527.0	356.4	51	-27.3	-0.3			*outlier*			222.9	341.7	22	-26.0	1.8	76.7	167.7	16	-24.1	2.9
	20-30	373.9	229.3	41	-26.9	0.8			*outlier*			394.5	469.5	21	-25.8	2.3	99.1	175.8	14	-25.5	3.0
	40-50			*outlier*			165.4	33.3	113	-25.3	0.7	427.7	387.5	25	-25.0	2.4	131.3	194.7	15	-25.1	2.3
	59-68	608.3	463.1	35	-25.8	0.7	82.1	33.9	64	-26.2	0.7	216.3	293.9	19	-25.6	2.9	59.4	118.5	13	-25.5	3.1
	68-80	499.3	283.3	56	-25.6	1.0	195.8	142.7	43	-25.7	1.3	228.1	386.5	19	-25.6	1.3	65.1	147.5	14	-25.4	2.3
core 4	0-10	543.0	385.7	24	-27.9	0.4	50.6	23.7	37	-26.9	1.5	105.7	141.3	13	-28.2	0.2	250.7	371.2	12	-27.7	0.3
	10-20	645.9	329.3	43	-27.3	1.2	34.5	18.2	42	-27.0	2.4	21.4	27.0	18	-27.7	1.3	249.3	480.9	12	-28.0	1.4
	20-30	419.3	199.1	39	-30.2	1.3	102.1	54.2	35	-30.4	2.4	94.3	108.4	16	-30.1	1.5	311.7	506.3	11	-30.4	1.6
	30-40	616.2	390.3	39	-30.6	0.2	81.9	35.1	58	-30.4	0.7	63.0	87.9	18	-30.0	0.6	208.3	416.6	13	-29.7	1.0
	40-50	157.0	85.6	28	-30.1	-0.2	114.3	60.0	29	-30.6	0.2	224.7	202.4	17	-30.6	0.3	431.4	522.9	12	-31.2	0.6
	50-60	52.5	27.6	25	-30.2	0.3	178.3	127.6	19	-30.1	0.6	456.1	466.9	13	-31.1	0.1	275.0	319.1	12	-31.3	0.3
	60-70	55.1	34.3	22	-31.2	0.0	190.1	140.4	18	-30.5	0.6	473.8	481.6	13	-31.5	-0.0	223.7	263.7	12	-31.8	0.4
	70-79	63.6	39.6	22	-30.4	0.5	147.9	104.3	19	-30.0	0.7	479.7	485.8	13	-31.2	0.2	249.2	289.96	12	-31.6	0.2

Table S3: Decomposition proxies a/oa ratio[1] and 70-75/52-57 ratio[2] obtained by ^{13}C CP-MAS NMR spectroscopy per depth layer for free particulate (fPOM), occluded particulate (oPOM), small occluded particulate (oPOMs) and clay-sized mineral-associated organic matter (MAOM).

	depth	**fPOM**		**oPOM**		**oPOMs**		**clay-sized MAOM**	
	cm	a/oa ratio	70-75/52-57 ratio	a/oa ratio	70-75/52-57 ratio	a/oa ratio	70-75/52-57 ratio	a/oa ratio	70-75/52-57 ratio
core 1	11-22	0.15	9.71	0.16	9.40	0.59	2.55	0.47	2.07
	22-30	0.15	6.96	0.16	8.68	0.58	2.49	0.52	2.26
	30-40	0.13	7.95	0.09	14.95	0.57	2.56	0.46	2.33
	40-50	0.12	11.38	0.12	10.27	0.63	2.23	0.62	2.06
	50-62	0.18	5.90	0.12	12.39	0.61	2.44	0.49	2.58
	62-75	0.21	5.21	0.10	11.57	0.61	3.15	0.47	2.53
core 2	30-40	0.18	5.80		*outlier*	0.54	2.68	*nd*	*nd*
	40-50	0.17	5.87	0.10	8.79	0.47	2.81	*nd*	*nd*
	50-60	0.12	7.36	0.14	5.68	0.34	2.77	*nd*	*nd*
	60-70	0.16	4.87		*outlier*	0.39	1.83	*nd*	*nd*
core 3	11-20	0.14	5.64		*outlier*	0.25	3.07	*nd*	*nd*
	20-30	0.16	4.21		*outlier*	0.26	2.65	*nd*	*nd*
	40-50		*outlier*	0.08	8.58	0.19	3.20	0.40	1.88
	59-68	0.25	3.80	0.09	5.81	0.28	2.77	*nd*	*nd*
	68-80	0.13	5.46	0.16	4.02	0.38	2.80	*nd*	*nd*
core 4	0-10	0.21	4.18	0.22	6.48	0.50	2.70	0.43	2.17
	10-20	0.08	5.27	0.21	4.28	0.67	2.42	0.47	1.71
	20-30	0.11	5.17	0.30	4.36	0.68	2.27	*nd*	*nd*
	30-40	0.16	4.88	0.09	9.38	0.48	3.15	*nd*	*nd*
	40-50	0.34	3.16	0.29	4.64	0.75	2.12	0.53	1.85
	50-60	0.32	3.75	0.39	3.79	0.55	2.50	*nd*	*nd*
	60-70	0.57	2.21	0.41	3.63	0.58	2.52	*nd*	*nd*
	70-79	0.38	4.34	0.42	3.83	0..55	2.65	*nd*	*nd*

[1] Ratio of alkyl C and O/N alkyl C according to Baldock et al. (1997).
[2] Ratio of the chemical shift regions 70 to 75 ppm and 52 to 57 ppm according to Bonanomi et al. (2013).

Figure S1: Exemplary ^{13}C CP-MAS NMR spectra of free particulate OM (fPOM), occluded particulate OM (oPOM), small occluded particulate OM (oPOMs) and clay-sized mineral-associated OM (MAOM) fraction of one depth layer.